VERIZON PETITION FOR RECONSIDERATION

Verizon requests reconsideration of one of the rules the Commission adopted in its April 21, 2015 Report and Order.\(^1\) That rule, Section 96.41(b), imposes very low power limits for small cells using the 3.5 GHz band. Those limits will force providers to deploy many more small cells to serve a given area and thus risk making deployment uneconomic. By increasing the power limits in Section 96.41(b), the Commission can provide operators much-needed flexibility to engineer their small cell networks efficiently, reduce infrastructure costs, and leverage existing small cell infrastructure, while still keeping cell sizes well below traditional macrocell levels. Specifically, the rule should set a maximum Effective Isotropic Radiated Power (EIRP) of 36 dBm for Category A uses (i.e., indoor or with limited antenna heights), 49 dBm for outdoor non-rural uses, and 56 dBm for outdoor rural uses. Authorizing those higher power levels will promote small cell deployments by wireless operators, which will help drive a device ecosystem that will benefit all stakeholders, and help the Commission’s vision for the 3.5 GHz band to succeed.

Establishing appropriate technical rules in this proceeding is challenging given that virtually no real-world learning exists about 3.5 GHz spectrum’s propagation characteristics when deployed on small cells. Despite the uncertainty, the Commission has generally balanced the “wide range of viewpoints and information” collected in this docket. But Verizon respectfully submits that one of the Commission’s conclusions—that Section 96.41(b) supports “multiple use cases” and “rapid network deployment”—does not place sufficient weight on the fact that higher power limits are essential to economically viable outdoor small cell deployments.

BACKGROUND

In its April 24, 2014 Order and Further Notice, the Commission proposed a technical rule (proposed Section 96.38) that set maximum power levels for non-rural and rural operations at 30 EIRP and 47 EIRP, respectively. Verizon’s comments explained that increasing those power limits would permit much more economical small cell deployments. Verizon noted, for example, that a 30 dBM EIRP limit for non-rural operations was actually lower than the standard power levels for Wi-Fi, and that it would not support the types of outdoor wide area coverage scenarios that Verizon envisions for the band. Verizon urged the Commission to increase the power levels substantially—to a total EIRP of at least 47 dBM for outdoor PAL usage.

No party disputed that higher power limits facilitate more economical small cell deployment, and the Commission’s April 21, 2015 Order acknowledged that fact. It stated, however, that it was striking a balance between that goal and its goal of promoting “spatial reuse.

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2 Id., ¶ 2.
3 Order, ¶ 205.
5 See, e.g., Verizon FNPRM Comments (filed July 14, 2014), at 7-8.
6 Verizon FNPRM Comments at 8.
7 Id.
8 Order, ¶ 214.
of the band, reduced coexistence challenges, and increased aggregate network capacity.”\textsuperscript{9} The final rule only slightly increases the power limits above the proposed limits, to 30 dBM for Category A (i.e., indoor or low antenna)\textsuperscript{10} uses, 40 dBm for Category B non-rural, and 47 for Category B rural.

**DISCUSSION**

Verizon’s experience in real-world small cell build-out underscores the importance of enabling 3.5 GHz licensees to be able to operate at higher power limits. Typical small cells in urban areas are up to 2 x 5 watts, which corresponds to EIRPs of up to 58 dBM for sectorized deployments and up to 51 dBm for omnidirectional cells.\textsuperscript{11} Those levels are much lower power than macrocells, which typically involve up to 40 watts, but they are substantially higher than the very low power levels authorized in Section 96.41(b). While Verizon would ideally deploy 3.5 GHz cells that mirror the geometry of existing small cells—which would allow Verizon to fully leverage its existing small cell infrastructure—this Petition does not seek any changes that would authorize that. Instead, the proposed power limit increases would partially close the size gap so that 3.5 GHz cells would be closer in size (but still much smaller) than typical existing small cells.\textsuperscript{12}

The power limits in Section 96.41(b) significantly limit the coverage that each small cell can achieve. That in turn will drive up network costs for three reasons. First, the licensee will need to purchase more small cells to provide quality coverage to the desired service area. Second, it will need to pay more to lease more spaces on towers, buildings and other locations for installing the additional cell sites. Third, it will need to spend more on the backhaul facilities

\textsuperscript{9} Id.
\textsuperscript{10} Id., ¶ 207
\textsuperscript{11} See attached Declaration of Max A. Solondz, ¶ 7 (“Solondz Decl.”).
\textsuperscript{12} Solondz Decl., ¶ 8.
(whether fiber or microwave) needed to connect each of those additional sites to the network. The higher these deployment costs are, the less economic investment in 3.5 GHz systems will be. There is a serious risk that the adopted power limit will impose costs that will retard investment in the new band.

Section 96.41(b) does allow operators to use sectorized antennas to theoretically increase cell ranges—much like a lawn sprinkler can be set on “jet” to achieve more range with the same water pressure—but this flexibility does not overcome the challenges that the power limits pose for efficient small cell deployments. Sectorized antennas are often an option for rural deployments where clutter is minimal, but not in urban and suburban environments where small cells are below the clutter, where their signals are more likely to arrive via multiple paths.\textsuperscript{13} Exclusively using sectorized antennas for covering reasonable-sized areas in urban or suburban environments would be inefficient and inconsistent with typical deployments in such settings.\textsuperscript{14}

Increasing the EIRP in Section 96.41(b) to levels closer to (but still lower than) real-world small cell deployments would substantially increase the attractiveness of 3.5 GHz spectrum for small cell deployments. There is no evidence that these power levels, which are much lower than traditional macrocell levels, would harm the innovative sharing framework set forth in the Order. To the contrary, by permitting operators to use 3.5 GHz to build small cells that are more commensurate with—while still smaller than—existing small cell deployments, the Commission can promote investment by wireless operators, which will help drive a device ecosystem that will benefit all stakeholders.

Finally, in revising the rule, the Commission can rely only on EIRP power limits to restrain power levels, rather than also prescribing the maximum level of conducted power. The

\textsuperscript{13} Solondz Decl., ¶ 9.
\textsuperscript{14} Solondz Decl., ¶ 6.
use of EIRP power limits to restrain power levels and coverage areas is adequate because EIRP reflects the combination of conducted power and antenna gain, i.e., for a given EIRP there is a sliding scale of higher antenna gain values combined with lower conducted power levels, and vice versa. As long as operators stay within the EIRP, they should have flexibility to optimize coverage patterns using different antenna patterns and gain levels.\textsuperscript{15}

\textbf{CONCLUSION}

For the reasons set forth above, the Commission should modify the power limits in Section 96.41(b) so operators in the 3.5 GHz band have the flexibility to deploy small cells with a maximum EIRP of 36 dBm for Category A uses, 49 dBm for Category B non-rural uses, and 56 dBm for Category B outdoor rural uses.

Respectfully submitted,

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July 23, 2015

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\textsuperscript{15} Solondz Decl., ¶ 9.
DECLARATION OF MAX A. SOLONDZ

1. I am a Distinguished Member of the Technical Staff for Network Infrastructure Technology Planning for Verizon. The group is responsible for advanced technology planning for Verizon Wireless, including new technology assessments, development of network evolution plans, participation in industry standard groups, and future spectrum planning. The group assesses the company’s ongoing spectrum capacity needs and identifies additional spectrum that can meet those needs both in the short term and over the longer term. In particular, I have been responsible for supporting the company’s various technical positions regarding the FCC’s plans for new spectrum and the 3500 MHz docket.

2. During my 29 year career in the wireless industry, I have served in a variety of product development, advanced technology development, technology assessment, system engineering, and product marketing positions. I have appeared on several wireless industry panels and programs concerning frequency allocation policy.

3. I submit this declaration in support of Verizon’s Petition for Reconsideration to be filed on July 23, 2015, in Docket No. 12-354. The Petition asks the Commission to increase the power limits in Section 96.41(b) so that they will support more viable indoor and outdoor small cell deployments. Specifically, it asks to increase the maximum allowed Effective Isotropic Radiated Power (EIRP) to 36 dBm for Category A uses, 49 dBm for Category B non-rural uses, and 56 dBm for Category B rural uses.
4. Real-world small cell build-out experience using other spectrum bands can guide what power levels would support investment in 3.5 GHz spectrum. For urban smallcell operations, Verizon expects the coverage and equipment needs for the 3550-3700 MHz band to be similar to our ongoing AWS-1 (Band 4) build-out. The build-out includes both microcells and macrocells. Even the microcell power levels are substantially higher than those currently permitted under Section 96.41(b), and are also higher than the proposed increased power levels that the Petition seeks.

5. In urban areas, Verizon has made extensive use of two single-band AWS microcell products. These products are:

   - The Alcatel-Lucent MRO 9768 Metro-Radio Outdoor for AWS (Band 4) (FCC ID: AS5BBTRX-17 [https://fccid.io/AS5BBTRX-17](https://fccid.io/AS5BBTRX-17)), and
   - The Ericsson mRRUS 12 AWS Band 4 microcell Remote Radio Unit (FCC ID: TA8AKRC161326 [https://fccid.io/TA8AKRC161326](https://fccid.io/TA8AKRC161326)).

Both of these are microcell AWS band products that have two transmitter ports capable of 37 dBm conducted power each (2 x 5 W). When considered for total EIRP, these two ports can be non-coherently summed for a maximum conducted power of 40 dBm (10 Watts total conducted power). Those power levels are much lower than power levels associated with traditional macrocells, which are typically 40 Watts total.

6. For AWS urban smallcell operations, Verizon typically uses both non-sectorized omni-directional antennas (for ‘single cell’ BTS coverage), and sectorized panel (directional) antennas (for ‘three sector’ sectorized BTS coverage). In urban areas, most use omni-directional antennas. Often, cables are very short, so cable loss is not included here.

7. The omni-directional antennas vary from 6 to 11 dBi antenna gain, depending upon the vertical half power beamwidth (and antenna length), enabling a maximum EIRP of 51
 dBm. The panel antennas vary from 9 to over 18 dBi antenna gain, depending upon panel size and both azimuth and elevation half power beamwidths, thus enabling maximum EIRP of 58 dBm.

8. For small cell deployments in the 3550-3700 MHz band, Verizon would prefer the flexibility to be able to replicate, or come close to replicating, the placements and geometry of its existing small cell deployments. Doing so would permit deployments of 3.5 GHz infrastructure based on known and proven business paradigms, and would permit Verizon to leverage its existing small cell infrastructure. The Petition, however, does not seek to increase EIRPs to levels in line with those used in the AWS context. Instead, it requests only 49 dBm total EIRP for Category B non-rural applications. The result is that under the proposed revised Section 96.41(b), urban small cells using 3.5 GHz spectrum would be smaller than existing ones using AWS, both because the allowed power level is lower and because the higher-frequency 3.5 GHz spectrum propagates shorter distances than AWS spectrum.

9. The revised rule should not prescribe particular combinations of allowed conducted power and antenna gain. Instead, any combination of conducted power levels and antenna gain should be permitted, as long as the total EIRP does not exceed the maximum. Allowing higher conducted powers (i.e., permitting operators to increase maximum allowed conducted power from 24 dBm total to 40 dBm total) will allow the service provider to choose the appropriate type of antenna for the urban environment. Often, non-directional low gain antennas are preferred in low antenna height, highly scattering environments, because one cannot depend upon narrow beamwidth antenna patterns to be maintained in such circumstances. Local obstacles and reflectors greatly
disturb the antenna patterns, and the resultant pattern, gain, and coverage often cannot be
met by a highly directional sectorized antenna.
I hereby declare under penalty of perjury that the foregoing declaration is true and correct to the best of my knowledge and belief. Dated this 23 day of July, 2015.

Max A. Solondz